MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2022/2023 SESSION (TERM ID 2220)

PTG0116 – TRIGONOMETRY AND COORDINATE GEOMETRY

(All sections / Groups)

13 JULY 2023
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 3 pages (excluding the cover page) with 4 questions and an appendix.
2. Answer all questions.
3. Unless stated otherwise, if an answer is given as a decimal, it should be rounded to four significant figures.
4. Write your answers in the Answer Booklet provided.
5. Show all relevant steps to obtain maximum marks.

Question 1 [25 marks]

(a) By using the conversion factor, convert
- (i) 0.4π radian to degrees. [2 marks]
- (ii) 23.987° to D° M' S''. Round your answer to the nearest seconds. [3 marks]
- (iii) 30° 300' 3000'' to degrees in decimals. Round your answer to two decimal places. [3 marks]

(b) Given $\sec\beta = -\frac{7}{2}$ where $\cot\beta < 0$.
- (i) Which quadrant is β in? [1 mark]
- (ii) A(x, y) is a point on the terminal side of β, and is r units from the origin. Find the values of x, y, and r. [3 marks]
- (iii) Find the exact value of $\csc\beta$ without a calculator. Rationalize your answer. [2 marks]
- (iv) Without using the calculator, find the exact value of $\sin 2\beta$. [2 marks]
- (v) Without using the calculator, find the exact value of $\tan\frac{\beta}{2}$. [2 marks]

(c)
- (i) Solve $\tan\theta = -0.3$ on the interval $0 \le \theta \le 2\pi$. [3 marks]
- (ii) Solve $\cos\frac{3\theta}{4} = -1$ on the interval $-3\pi < \frac{3\theta}{4} < 4\pi$. [4 marks]

Question 2 [25 marks]

(a) Given $a = 5 - 4i$ and $b = 1 + 2i$, find:
- (i) ab in standard form $x + yi$. [2 marks]
- (ii) $2\overline{a} - 3\overline{b}$ in standard form $x + yi$. [3 marks]
- (iii) $\frac{b}{a}$ in standard form $x + yi$. [3 marks]

(b) Convert $-5 + 4i$ to polar form. Express the argument on the interval $[0, 2\pi)$. [4 marks]

(c) Given $\underset{\sim}{p} = 5\underset{\sim}{i} + \underset{\sim}{j} - 2\underset{\sim}{k}$, and $\underset{\sim}{q} = 10\underset{\sim}{i} - 9\underset{\sim}{j} - 3\underset{\sim}{k}$.
- (i) Find $|-2\underset{\sim}{p} + 3\underset{\sim}{q}|$. [3 marks]
- (ii) Determine whether $\underset{\sim}{p}$ is orthogonal to $\underset{\sim}{q}$. [3 marks]
- (iii) Find a vector which is orthogonal to both $\underset{\sim}{p}$ and $\underset{\sim}{q}$. [2 marks]
- (iv) Determine whether $\underset{\sim}{p}$ is parallel to $\underset{\sim}{q}$. [2 marks]
- (v) The position vector of the point M and N are $\underset{\sim}{p}$ and $\underset{\sim}{q}$ respectively. Give the coordinates of both the points M and N. Then, find the vector $\overrightarrow{MN}$. [3 marks]

Continued...

Question 3 [25 marks]

(a) An ellipse is described by $x^2+9y^2-10x-72y+160=0$.

(i) Transform the equation to the standard form. [4 marks]

(ii) Find in the characteristics of the ellipse in the following table. [8 marks]

Type of ellipse	
Centre	
Vertices	
Co-vertices	
Distance of foci from centre	
Length of minor axis	

(b) A circle is described by $x^2+y^2+6x+4y-12=0$.

(i) Transform the equation to the standard form. [2 marks]

(ii) State the radius and centre of the circle. [2 marks]

(iii) Find the y-intercepts of the circle. [2 marks]

(iv) Sketch the circle. [7 marks]

Question 4 [25 marks]

(a) Find A^{-1} using cofactors if $A=\begin{bmatrix} 6 & 1 & 2 \\ 2 & 3 & -3 \\ -1 & -4 & -5 \end{bmatrix}$. [12 marks]

(b) Write the following linear system in matrix form. Then, solve it using Cramer's rule.

$$2a+b+4c=7$$
$$a-2b-3c=11$$
$$-3a+3b+c=-30$$

[13 marks]

Continued...

APPENDIX

$$\tan\theta = \frac{\sin\theta}{\cos\theta}$$

$$\csc\theta = \frac{1}{\sin\theta}$$

$$\sec\theta = \frac{1}{\cos\theta}$$

$$\cot\theta = \frac{1}{\tan\theta}$$

$$\sin^2\theta + \cos^2\theta = 1$$

$$\tan^2\theta + 1 = \sec^2\theta$$

$$1 + \cot^2\theta = \csc^2\theta$$

$$\sin(-\theta) = -\sin\theta$$

$$\tan(-\theta) = -\tan\theta$$

$$\cos(-\theta) = \cos\theta$$

$$\cos(A+B) = \cos A\cos B - \sin A\sin B$$

$$\cos(A-B) = \cos A\cos B + \sin A\sin B$$

$$\sin(A+B) = \sin A\cos B + \cos A\sin B$$

$$\sin(A-B) = \sin A\cos B - \cos A\sin B$$

$$\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A\tan B}$$

$$\tan(A-B) = \frac{\tan A - \tan B}{1 + \tan A\tan B}$$

$$\sin 2A = 2\sin A\cos A$$

$$\begin{aligned}\cos 2A &= \cos^2 A - \sin^2 A \\ &= 2\cos^2 A - 1 \\ &= 1 - 2\sin^2 A\end{aligned}$$

$$\tan 2A = \frac{2\tan A}{1 - \tan^2 A}$$

$$\sin^2 A = \frac{1 - \cos 2A}{2}$$

$$\cos^2 A = \frac{1 + \cos 2A}{2}$$

$$\tan^2 A = \frac{1 - \cos 2A}{1 + \cos 2A}$$

$$\begin{aligned}\tan A &= \frac{\sin 2A}{1 + \cos 2A} \\ &= \frac{1 - \cos 2A}{\sin 2A}\end{aligned}$$

$$\sin A\cos B = \frac{1}{2}\left[\sin(A-B) + \sin(A+B)\right]$$

$$\cos A\cos B = \frac{1}{2}\left[\cos(A-B) + \cos(A+B)\right]$$

$$\sin A\sin B = \frac{1}{2}\left[\cos(A-B) - \cos(A+B)\right]$$

$$\sin A + \sin B = 2\sin\frac{A+B}{2}\cos\frac{A-B}{2}$$

$$\sin A - \sin B = 2\cos\frac{A+B}{2}\sin\frac{A-B}{2}$$

$$\cos A + \cos B = 2\cos\frac{A+B}{2}\cos\frac{A-B}{2}$$

$$\cos A - \cos B = -2\sin\frac{A+B}{2}\sin\frac{A-B}{2}$$

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